NAC Technology and Innovation Committee Meeting Minutes

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Opening Remarks and Thoughts—Esther Dyson

Ms.. Dyson introduced Mike Green, who is assuming Rick Howard's duties as executive secretary of TIC. She hopes to have a joint meeting in August with the Commercial Space Committee before the full NASA Advisory Council (NAC) meeting, which is scheduled for August 4 to 6, probably at the Jet Propulsion Lab (JPL) in California. The membership of this committee may be expanded.

President Obama spoke in Florida on Thursday (April 15) and gave the rationale for NASA's new budget. Once approved, it will enable NASA to engage in serious long-term research, diverting space exploration to commercial space flight. NASA seeks real advice from the Technology and Innovation Committee (TIC). NASA has been dominated by human space flight issues, while technology has tended to be neglected. NAC committees are not connected to any mission directorate; they used to go through an Associate Administrator (AA) and advised the AA on formulating the budget, but now committees are used similarly, but more informally.

For the future, the United States could be giving money to advance commercial space flight instead of supporting the Russian Soyuz, which we use to get to and from the International Space Station (ISS). Other issues are how to package our recommendations to sell them. Whatever we recommend must contribute to national needs—whether it be national security, economic benefit, inspiring the next generation. The media's "canceling the Moon program" headlines are not helpful. The NAC Aeronautics Committee has produced a document equivalent to a decadal survey for science. Ultimately that kind of product would be good for Space Technology because it is something concrete that says what we should be doing in technology and innovation. We need to help communicate the difference between engineering and technology, and for this we should be working with the Committee for Education & Public Outreach. We may want to have a joint meeting with them.

In addition to clear societal benefits, the kind that compete with cancer research, etc., there is the political benefit of human space flight. Space technology is supposed to be cross-cutting, not mission-directed. It is more fundamental with broad applications; it is game-changing things we should be doing, e.g., nanopropellant. If technology could be crafted to get to Mars in 5 days, it would be truly game-changing and open up the whole solar system. Our focus is on what they're going to do in the Exploration Systems Mission Directorate (ESMD) and what the Office of the Chief Technologist (OCT) could do to augment that investment.

Discussion

- We need a compelling narrative to sell big science programs. Otherwise, it will be a collection of ideas, and the programs will look like a Works Progress Administration (WPA) program. However, TIC's mission is not to fund programs. We neither make these decisions nor do we lobby Congress. We inform people who do.

Investments in the Future: NASA's Technology Program— Dr. Robert D. Braun, NASA Chief Technologist

This Administration takes a strong position on the importance of technology innovation: we heard it in the President's speech last week, and we hear it in every meeting because it is viewed as tied tightly to economic competitiveness, high-tech jobs, and the future of the nation's R&D machine. In addition, Congress is forcing the discussion on the connection to the industrial base, particularly in propulsion. But discussions are much broader than jet propulsion and include the NASA Centers and how NASA can return to its precursor, the National Advisory Committee for Aeronautics (NACA), which worked with the fledgling aeronautics industry in the 1950s, helping to create the airlines industry. Its original board included Lindberg and one of the Wright brothers, people who were trusted. Dr. Braun thinks that, similarly they want a NASA that is engaged with industry, largely commercial human space flight, and they want NASA to be supportive of industry so these companies will grow and grow our country (conversely, Constellation was entirely NASA-driven). They also talk about reengaging universities and students. And, all of these discussions always return to the economy. They like the knowledge gained, but economy, not a particular NASA mission, is the focus the Administration's concern.

The Office of the Chief Technologist (OCT) is taking a 3-pronged approach: commercialization; inspiring young people to go into science, technology, engineering, and mathematics (STEM); and technology and innovation as a driver of the economy. The NASA budget reflects this, as well as the budgets of other government agencies. The only agencies that got an increase in discretionary spending were those that had an R&D program. The choice is not Constellation or technology. If NASA does not do technology, that money will not go to Constellation. (Norm Augustine was right that Constellation was unsustainable.) One solution would be to fly the Shuttle forever, which could be done if we did nothing else. Some Members of Congress have questioned the cancellation of Constellation because of loss of jobs among their constituents; they want to put additional money into it rather than do new things. This Administration believes Constellation would not stimulate the economy and provide as many high-tech jobs or increase the number of students going into STEM as a program on technology and innovation would.

Working with mission directorates to integrate with what they are doing, Dr. Braun has put together a team. External input has driven development of NASA's technology-enabled approach; NASA did not decide on its own that it wanted this approach. In the last few years, reports from the National Research Council (NRC) and the Augustine Committee have advocated it, as has Congress. All conclude that NASA needs to do a better job in technology and innovation. In fact, all of Mr. Augustine's options had technology and innovation in them.

In considering what technologies to invest in, Dr. Braun read dozens of reports written by different groups between 1969 and 2009. There is strong correlation among them, and all cite the need for NASA to invest in technology. However, the consistency means NASA has not done much along those lines. The value of technology investment is illustrated by the Mars mission, the Administrator's ultimate goal and NASA's grandest challenge. Without technology investments, the mass required to initiate a human Mars mission in low Earth orbit (LEO) is about 12 times the mass of the ISS; with technology investments of the type proposed in the FY2011 budget, such a mission is within reach.

The OCT has begun the Space Technology Program to use disruptive approaches with game-changing technologies for transformational R&D, and cross-cutting capability demonstrations for testbeds and small-scale demonstrations. They are gathering the best ideas from wherever they come—and they expect to get thousands of potential visions for the future—and then they will attack the fundamental physics problems. Within the Space Technology Program (as in the Defense Advanced Research Projects Agency [DARPA]), they will look at ground-based, space-based, game-changing, and crosscutting technologies and demonstrations and will prove them in flight or in the lab.

The Exploration Systems Mission Directorate (ESMD) and OCT overlap, but differ in their approaches. ESMD's Enabling Technology Programs resembles the New Millennium Program. ESMD requires a flow-down approach. Since it is not possible to know all the missions of the future, we need disruptive approaches in addition to a requirements–flow-down approach—i.e., both a technology pull and a technology push program working in balance. This approach actually goes back to NASA's former approach, but in the last few years, the technology-push piece had disappeared.

The Space Technology Program shall advance non-mission–focused technology for multiple customers (i.e., someone who will put money into it), which will be matured through a steady cadence of technology demos, continuous calls, and continuous ideas generated. After initial test flight, this will expand to long-duration commercial human space flight capabilities. NASA's technology development programs include early investment in the long-lead capabilities needed for future deep space and surface exploration missions. A broad portfolio of technology will be needed because we don't know exactly what we will want, and we need parallel approaches. The major change is that research and technology have balanced with the other 2 core competencies (hardware development and mission operations).

The Space Technology program is managed in 3 divisions—early stage innovation, game-changing technology, and crosscutting capability demos (proved in a space environment)—at progressively increased technology readiness levels (TRL). The operative questions move from the vision or crazy ideas to, Does it work? to, Is it flight ready? All projects will be competitive in open calls, so they could come from other agencies, academia, or the commercial sector. We would like to increase teaming.

In setting up this program, Dr. Braun tried to differentiate it from the missions' technology programs. The program will meet the nation's needs for new technology to support NASA missions in a manner similar to NACA's. The portfolio approach is competitive and will leverage technological investments from international organizations, government agencies, academia, and industrial partners and will result in new inventions, new capabilities, and the creation of a pipeline of innovators trained to serve future national needs.

The program's 3 divisions are:

1. Early-stage Innovation division for creative ideas. Programs included in this division are the NIAC; Space Technology Research Grants; SBIR/STTR; Centennial Challenges; and the Center Innovation Fund.

2. Game-Changing Technology division works to prove the feasibility of novel, early-stage ideas that could revolutionize a future NASA mission or fulfill national need. The programs included in this division are Game Changing Development and the Small Satellite Subsystem Technology.
3. Crosscutting Capability Demonstrations division works on the maturation to flight readiness of crosscutting capabilities that advance multiple future space missions, including flight test projects where in-space demonstration is needed before the capability can transition to direct mission application. The programs included in this division are Crosscutting Technology Demonstrations, Edison Small Satellite Demonstration Missions, and Flight Opportunities.

The Chief Technologist reports directly to Administrator Bolden. In addition to managing the Space Technology Program, the office is responsible for being the principle NASA advisor and advocate on matters concerning Agency-wide technology policy and programs; advocating for NASA research and technology programs and communication and integration with other Agency technology efforts; coordinating technology investments across the Agency, including the mission-focused investments of NASA mission directorates and strategic technology integration; changing culture toward creativity and innovation at NASA Centers, particularly regarding workforce development; and documentation, demonstration, and communication of societal impacts of NASA technology investments, including leading technology transfer and commercialization opportunities across the Agency. Dr. Braun has established the NASA Technology Executive Council (NTEC), which, in addition to himself and Mike Ryschkewitsch (Chief Engineer), is composed of each mission directorate Associate Administrator (AA). The Council will meet regularly to oversee and manage the Agency's technology programs. The NTEC will provide strategic integration of NASA's technology investments and will seek to minimize duplication, perform gap analysis and seek synergy. Dr. Braun also discussed the process for developing the Aero-Space Technology Area Roadmap (A-STAR), which will be a set of roadmap documents that make recommendations covering NASA's current and planned technological investment over 20 years. A-STAR will cover about 15 technology areas through a peer-reviewed process in an open and transparent process.

In sum, a NASA focused on technology and innovation drives the nation's economic competitiveness; serves as a strong motivation for young people to pursue STEM education and career paths; and allows NASA to apply its intellectual capital to develop technological solutions addressing broader national needs in energy, weather, and climate.

Exploration Systems Update and Status— Dr. Laurie Leshin, Exploration Systems Mission Directorate (ESMD)

NASA's Commercial Human Space Flight Program seeks to extend human presence throughout the solar system. The President's proposed FY2011 budget changes the philosophy and approach, but not that fundamental goal. It focuses on capabilities that will allow us to reach multiple destinations, including the Moon, asteroids, Lagrange points, and Mars and its moons. Investments seek new knowledge and capabilities required for humans to venture beyond LEO, and expands alternatives available for human exploration. The budget reflects the concept that we don't know enough or have capabilities to go all the places to which we would like to go. The hardest part is landing on another planet, so this approach seeks to develop systems methodically moving to ever-increasing difficulty until astronauts land on another planet.

The proposed budget will invest an additional $6 billion in NASA over the next 5 years—an overall $100 billion commitment to the Agency. Of this, ESMD's proposed budget is $4.3 billion for FY2011, an increase of $0.5 billion over FY2010. The President's budget challenges NASA to embark on a new human space exploration program that invests in first obtaining key knowledge and then demonstrating critical enabling technologies, including R&D of heavy-lift and propulsion capabilities, transformative technology development, and flagship technology demonstrations to reduce cost and expand capabilities of future human exploration activities (a big flight program); exploration precursor robotic missions (perhaps in collaboration with the Air Force and the National Reconnaissance Office); expansion of U.S. commercial space flight capabilities; and increased investment in human research. The budget cancels Constellation, but retains block zero Orion, which can be used as a crew rescue vehicle for ISS.

Strategies for future human missions begin with potential destinations (mission analyses), common capabilities (a combination of technologies in systems design), and technology-building blocks. The Human Exploration Framework Team (HEFT) is building a framework to view the progress of 5-year investments and technologies. It will enable seeing requirements for various parts.

New activities in exploration R&D focus on: exploration technology demonstrations ($7.8 billion over 5 years), which will develop and demonstrate technologies to reduce costs and expand capabilities for future exploration; heavy-lift and propulsion technology ($3.1 billion over 5 years), which will research and develop new cost-effective systems, engines, LV materials, etc.; and exploration precursor robotic missions ($3.0 billion over 5 years) to scout exploration targets and identify hazards and resources for human visitation and habitation.

NASA doesn't do portfolio management very well; a way must be defined for the OCT and ESMD parallel lines to cross. ESMD has foundation or core areas that can flow into small-scale flight demonstrations and wind up with a portfolio of things that have been proven and demonstrated. To support R&D it is necessary to be able to define cost and risk. The grand challenges that cut across everything justify the different levels of investment. Enabling technology development and demonstration (ETDD) is also known as small technology programs, such as *in situ* resources, human–robotic partnerships; landing autonomously, precisely, and safely on extra-terrestrial surface of uncertain environment; and reducing travel time and cost for deep-space human exploration.

Foundational technology domains address long-range capability needs for multiple destinations. The exploration technology development and demonstration approach establish a series of goals—demo 1 lunar volatiles, demo 2 high-power electric propulsion, demo 3 autonomous precision landing, demo 4 operating robots from orbit, demo 5 fission power systems. A roadmap is developed for each demo in time order. Readiness and flight operations determine priority for funding. The various technologies have to be integrated, but over the next 5 years they should get a many opportunities to demonstrate them, and we have to be ready to do that.

Heavy-Lift and Propulsion Technology (which Marshall will manage) will investigate a broad scope of research and development activities related to space launch propulsion technologies with the program goal of providing new national capabilities, reducing costs, and shortening development time for future HLP systems. Projects may include commercial, academic, and international partnerships. Building on good current investments, new investments will lead to heavy-lift vehicle architecture selection in the 2015 timeframe.

Coordination across agencies is now done agency to agency. For closer coordination we may need a more formal plan facilitated by OSTP and involving the National Security Council, and we may need to form a working group. Coordination is underway with DOD. The challenge with the Air Force is that they no longer have acquisition authority.

Flagship technology demonstration's Mars destination is a driving case for high-leverage demonstrations and technologies. In FY2011, 4 technology demonstrations will be initiated. Evaluation of the highest leverage demos is underway for in-orbit propellant transfer and storage, lightweight/inflatable modules, and automated/autonomous rendezvous and docking. A fourth flight program could be aero-capture entry, descent, and landing; advanced life support; or advanced in-space propulsion. Potential partners with industry, other agencies, and international partners must be identified, and ISS will be leveraged for technological demos as appropriate. This approach positions ISS more in the path of exploration.

The portfolio seems to be balanced. The reports for the past 20 years have recommended the same things and with this approach we will be able to do many instead of just a few. One challenge is the politically intractable human capital piece—people cannot be laid off to adjust the workforce for needed expertise. But the biggest challenge is fixed costs, e.g., a Shuttle program entails massive carrying costs, i.e. $3.5 billion per year whether you fly it or not.

Exploration Precursor Robotic Missions (xPRM) maintains a steady tempo of exploration missions and investigations to address priority needs in preparation for human exploration. At least 2 missions will be initiated in FY2011 for which candidates include: lunar missions, reconnaissance of or landing on near-Earth asteroids or moons of Mars; landing *in situ* resource utilization capability to process lunar or asteroid materials into fuel or other enabling materials; and Mars precursor measurements and demos. This program will emphasize partnerships among directorates, agencies, other nations, and commercial enterprises, which will influence the direction, e.g., international partners want to focus on robotic missions. xPRM will provide a venue for flight validation and infusion of developed technology and for participatory exploration opportunities. Priorities include identifying hazards, resources, engineering boundary conditions. Portfolio components are: exploration precursor missions (generally $800 million or less); small, more risky exploration scout missions ($100 million to $200 million) led by their principle investigator; missions of opportunity instrument/capability development ($15 million to $75 million); and research and analysis.

The Human Research Program addressees applied biomedical research in space, i.e., issues of long-duration human residence in space—radiation, behavioral health, bone loss, cell research, effects of microgravity. The investment in the National Space Biomedical Research Institute was increased and becomes part of ISS utilization.

For commercial cargo, additional $312M in FY2011 to accelerate the achievement of already-planned milestones or introduce new milestones that would ultimately improve mission success. For commercial crew, NASA plans on using a COTS-like approach to support the development of commercial crew transportation providers to whom NASA could competitively award a crew transportation services contract analogous to the CRS services contract for cargo. NASA will set standards and have appropriate insight/oversight to ensure that all systems meet the agency's human-rating requirements to maintain the necessary level of safety

Development of a commercial crew transportation provider is controversial. One problem is that the failure rate on commercial projects is substantially higher than government launches because lessons learned don't translate across programs. Embedding NASA people within the commercial ones is being discussed in a transition from "insight" to oversight. We want to split the business process from the mission assurance process. We have to show how we're going to do all this, including a full-force business model.

The President's FY2011 budget for ESMD proposed an exciting, vigorous set of new programs that will bring much-needed new capabilities to fruition and provide critical precursor knowledge that will ultimately enable a sustainable plan for sending humans into the solar system to stay. Key investments in new and innovative capabilities will expand our exploration opportunities, reduce mission costs, contribute NASA innovation to broader national needs, and promote STEM education for the future. For more information see <http://www.nasa.gov/budget>.

Discussion

- TIC could recommend that the National Space Biomedical Research Institute be further considered. How will ISS be exploited?
- The graphic showing NASA's progress is helpful, but needs specific examples, without which opponents could derail Dr. Braun's efforts. The plan is DARPA-like, but the manager still must sell his program, so he needs a concrete, vivid, and credible story. He needs to be able to answer the question, "If we gave you this money, what would you do with it?"
- ESMD would like advice and support on medical issues.
- For OCT and ESMD to work together entails having agreements in place from the beginning. In game-changing technology, how do 2 groups actually change the game?
- We haven't had advanced propulsion for a long time, so at the next meeting, we would like to hear about that. Propulsion research is being done in many different pieces, so an integrated picture of propulsion would be important.
- TRL 6 is tested in a flight-like environment; lower numbers are earlier stages of research.
- Centers are key, so we need to collaborate with them. Then Centers become the catalyst and conveners.

Innovation and Technology—Jason Crusan, Space Operations Mission Directorate (SOMD)

SOMD has no technology and innovation budget; it's an operations organization. SOMD innovation is divided into 3 areas: mission-focused innovation needed to conduct the primary mission, new or enhanced capabilities that allow for a more robust solution or lower long-term operation costs, and participatory public engagement and innovative methods to reach the public. SOMD's mission-focused innovation includes advancing ISS use as the U.S. National Lab. To maximize return on investment, Congress has authorized opening its use to non-NASA investigators, including commercial interests.

These organizations invest their own non-reimbursable money for the opportunity to conduct space research, without the cost of accommodations and launch. With the FY2011 budget, ISS's life as a testbed, including a robotics testbed, has been extended at least until 2020. Functions and capabilities are being expanded with the International Docking Standard (which defines who can use what ports), enhanced computing and communication systems, increased utilization accommodations, and enhanced stowage. In February, NASA issued a call for proposals with the Research Development Test and Evaluation Initiative.

Users can be categorized in 3 communities: national partners, NASA requirements, and non-NASA use, including commercial entities. SOMD has been directed to have the non-NASA part directed by a not-for-profit organization, which, unlike NASA, would market services and determine use policy, prioritization, and manifest strategy. Current national lab partners include NIH, National Science Foundation, USDA, University of Colorado, Spacehab Inc, Zero Gravity Inc, Ad Astra Rocket Co, NANORACKS LLC, and Microsoft; and memoranda of understanding are pending with USGS, NOAA, DARPA.

A commercial company, Hamilton, is testing a water-production system on ISS, one that NASA can buy as a service that can be turned on and off at will (availability basis). Hamilton takes 100% of the risk for their performance for this 5-year service contact. NASA provides oversight only from a safety perspective. Launched on the most recent mission, their advanced 4-stage compressor system produced from 1000 to 2000 liters at a cost of $40,000 to $60,000 per kilogram, which pays for itself after a year and is quantum leap over the currently used Russian technology. In such arrangements, development cycles are treated like capital equipment. SOMD would like to see this sort of thing expanded, but future service contracts are obstacles unless the contracting community takes on the appropriations risk. For these to be successful, NASA must have solid performance requirements.

Technology in SOMD beyond ISS consists of transformation tasks and hands-on demonstrations tasks with hardware or real test results on operational systems involving 3 months, 3 or fewer people, less than $300,000, and no paperwork. They need access to decision makers, e.g., when fixing line breaks, they found that hydrazine can be neutralized to a product has saleable byproduct and does not produce hazardous waste. The CubeSat Launch Initiative will provide launch services on ELV and CRS launches with auxiliary payload. They are receiving proposals and will do an integrative review across mission directorates. Innovative communication methods offer access to space opportunities for the general public through Web and social media tools and traveling educational exhibits. Partnerships with the public are being built, e.g., integrating astronaut photos with Google and Earthlink. Astronaut Soichi Naguchi"tweeted" an image from space. Participatory public engagement and education programs involve students in building hardware, e.g., a work table, which will advance the workforce toward trades.

Education onboard opens ISS to high school and undergraduate students in programs such as the Zero-Robotics Pilot, which will be expanded over the next year with partnership with DARPA's SPHERES program. Another is Kids in Micro-g, a student experiment design challenge; and HUNCH for middle and high school students to build flight and training hardware for use on ISS, and which is now expanding to US Military Academy.

Discussion

- TRL is valuable from a technology advancement standpoint, but from an operational readiness point of view, it is a concept. SOMD balances the TRL scale with integrated hazard analysis. Readiness and reliability cannot be separated in risk analysis, and redundancy must be built in. Orbital Research Laboratory (ORL) is part of the decision factor.
- Unless adding modules, up-mass is not a constraint. Down-mass will continue to be an issue. Can we enhance orbit processing?
- Assume that commercial vehicles will be operating. Once the CRS flights are up to their regular schedule, we could see up to 7-8 flights a year between CRS and partner flights of cargo going to ISS. Otherwise a flight every month and half.
- Costs can be driven much lower than they are today because they will use class D hardware, and mission success criteria will be less stringent.
- If we can change the philosophy on ISS use, if we can drive the turnaround time—concept to flight—to 6 months, then it will be a real lab. We need to know how to build space hardware in orbit, e.g., how to use solder. If it won't cause the space station to fall, who cares if it fails?
- The FY2011 budget allocates money for integration costs.
- Use policy is based on NSF's Office of Polar Programs in which NSF pays for the station, and the researcher pays for the research.
- So far, 89 proposals for research on ISS have been received from the cross-agency call, ranging from less than $750 thousand to $4 million. To prioritize, each mission directorate is ranking them independently and the Associate Administrators will combine them into existing programs. There is no fixed budget for these. SOMD did not get a technology research budget. OST, SMD, and the mission directorates will have to align it with their budgets.
- ISS is an acquisitions test bed; it can do neither a CRS nor a commercial crew. Flight hardware will essentially be a service contract. SOMD's main role is integration of projects among all program budget managers, but they don't need a lot of money for this. They have a very capable platform that has accommodated humans in space for more than 10 years.
- Mr. Crusan advocates using ISS as first stepping stone from which to learn. We need to utilize ISS in a multifaceted function including acquisition and technology, and operations people need to be at the table. We should be flying demo missions on every shuttle flight. Injecting these ideas into other programs implies many people talking to each other. If ESMD were SOMD, Mr. Crusan would not wait until the end to combine everything, but do so as they go along. It's about getting the right people to hear the right thing at the right time. They do not do peer review *per se.* If things can be run quickly enough, money be can saved, but it must be done safely.

Conversation with Bobby Braun

Discussion on Process and Procedures

- It is important to have concrete projects like SOMD's in which initiatives depend on funding from other people. (ESMD is more focused on structure, but Dr. Leshin was reporting on 2 months' work.)
- There is a fertile ground on which to spend money, and Dr. Braun needs to integrate the ideas.
- Although using a business model, NASA has key grant challenges to address, e.g., high-risk vs. mission-oriented.
- Use the same process and procedure slides, but instead of talking about programs, talk about a technology: the mission directorates' approach vs. the Office of the Chief Technologist's approach.
- Prioritization, process, programs—the inevitable budget clash will change these things, so we need a process to deal with disappearing money.
- Dr. Braun set up the NASA Technology Executive Committee (NTEC), a decision-making body composed of the four Mission Directorates AA's and Dr Braun, who control the budget and who have funding and technology programs, plus Mike Ryschkewitsch, Chief Engineer. NASA is close to announcing the Chief Scientist, and that person will be a member of the NTEC. If they disagree among themselves, they will seek adjudication from the NASA Administrator. They will meet in May for the first time. All are now formulating their program need to be able to speak with one voice.
- Dr. Braun's biggest programs will be crosscutting capability demos. They won't spend money unless someone wants the product and is willing to help pay for at least 25% of it (part of the selection criteria for proposals). This gets to TRL6, the standard NASA criterion for infusing a technology into a mission.
- The non-mission–focused approach is generally favorably received, but Dr. Braun has been asked whether the budget is enough or too much. He asked TIC members to get data to answer this question, e.g., Silicon Valley companies spend a certain amount on disruptive technologies. Can TIC members get benchmark data? He and Dr. Ryschkewitsch will integrate the various benchmarks. The operative amount to spend is what you can afford or get into the budget—then you figure out how to make effective use of that amount.
- How much should OCT emulate Google? How do big companies support the big winners?
- You must be creative about business models and how you get resources. You want scientists to be driven by passion, not cost accounting.
- Some stress can be constructive tension will aid the process.

Discussion on Staffing:

- NASA is going to a unified labor account next year, so everyone will be taxed. The motivation for instituting unified labor is the inability to do full-cost accounting at a government agency; if the person cannot charge work to a particular project, the person still cannot be written off. That is, full-cost accounting was implemented, but not full-cost management. They will still track who's working on what project and use that as a basis for assessing a "tax," but the tax system will eliminate the stress on the work force for

what project to charge labor. They are still accountable to the project for deliverables. It's much the same as it was, but eases the accounting burden.
- To encourage NASA research centers to work together and be more innovative they should not be divided at the beginning. The process will be entirely competitive and will encourage teams. Intergovernmental Personnel Act (IPA) is an important tool for bringing external technical experts into NASA for temporary (1-3 years) periods of time. OCT will find the nation's expert on whatever the topic and hire or "borrow" that person, as DARPA does.
- As for staffing the program offices, they have had a few transfers from Headquarters, and have called for details from all the Centers for next year. Next month they will advertise for applicants for 15 positions. This is not the quickest way, but it is a better model for this office.
- NSF has information and might want to pick a sister benchmarking organization and exchange data. They could give insight because they have some of the same issues and problems and NASA.

FACA Overview—P. Diane Rausch

The Federal Advisory Committee Act (FACA) was enacted in 1972 in an attempt to cap what people do in advisory committees. Congress wants to know whether these committees were worth the expense or a waste of time and money. They want to know what the committees do and why—it's about accountability. The Freedom of Information Act (FOI) and ethics laws are related efforts at transparency and accountability.

All the agencies together have some 1000 FACA committees with more than 60,000 members. The Department of Heath and Human Services (DHHS) has the most because NIH formally charters all peer review panels (which are all closed because they deal with proprietary information). NASA has always had from 2 to 26, including 2 standing committees, NASA Advisory Council (about 30 years) and the Aerospace Safety Advisory Panel (more than 40 years). The committees' purpose is to provide advice on important relevant objectives. By law, they are open to the public and comply with reasonable cost controls and recordkeeping requirements. If not renewed, they end after 2 years. The 3 types in the Executive Branch are: statute, presidential or federal agency, or an existing group utilized by the President or a federal agency. Each must contain at least 1 non-federal employee. However, FACA exists in administrative law not criminal law, and violation does not result in jail time.

Answers to the following questions determine whether FACA applies:
1. Does the group provide collective advice? The goal is to come together and make a recommendation, a group product, a consensus activity.
2. Who does the group advise? An executive officer, e.g., Administrator Bolden.
3. Who are the group's members? It involves outside people.
4. Who established the group? An Executive Branch agency, e.g., NASA.
5. Who controls the group's activities? A federal official is responsible for developing the agenda, paying for it, managing it, etc.

FACA requirements:

1. Develop and file a charter with Congress.
2. Maintain a balanced membership having diverse opinions.
3. Hold open, public meetings.
4. Keep minutes or summaries of meetings.
5. Allow public filing of written statements (*de minimus* rule) distributed to members. This can also be done in an open forum for the public.
6. Announce all meetings in the *Federal Register* 15 days in advance.
7. Maintain all committee documents for public inspection. These are now posted on the Web.

FACA committees must have a charter—the NASA Administrator determines that the advisory committee is essential and sets out the mission, responsibilities, and costs. The General Services Administration (GSA) must approve it, and the Committee Management Office (CMO) oversees compliance issues and produces an annual review for the public Web site of all meetings. Every year, the FACA committee receives an ethics briefing and members must update their financial statement. A Designated Federal Official (DFO) attends meetings and approves agendas and press releases. Anyone can nominate members; the agency head formally appoints them. The membership must be fairly balanced (as to points of view). There are 3 types of members—special government employees (SGE), representatives, and regular government employee—and, for this purpose. SGE are required to submit a financial disclosure form (#450). Representatives serve to represent official policies or views. FACA goals include:

- Reducing inappropriate influence on government decisions
- Eliminating government decisions made behind closed doors
- Improving public confidence in agency decision-making
- Allowing public contemporaneous access to decision process
- Ensuring positive public perception of the executive branch
- "Good government"

FACA ensures public access, not public participation. All deliberations that seek to reach consensus must occur in a public meeting. Consensus requires a quorum (half of the number of members plus 1) To assure public assess, notice of the meetings must given in advance (i.e., published in the *Federal Register*); meetings must be held in an accessible location and committee information must be accessible. The public may submit documents or written statements. However, virtual committee meeting deliberations (telecoms/video/webex) are allowed, as long as they comply with the requirement for advance notice, accessibility, etc.

Closed meetings (rare at NASA) are held when the committee deals with national defense or foreign policy matters, or when proprietary information or contractual matters will be discussed. This must be taken to the agency's head and publish in the *Federal Register*, so it needs to be decided 45 to 60 days in advance. Alternatively, a non-FACA meeting may be convened to deal with administrative or preparatory work (agenda, fact-finding, site visits, tours, draft position papers). But, a non-FACA meeting determination memo is required in advance for each such meeting; no deliberations are allowed and no recommendations may be developed. All deliberations and recommendations must occur during a FACA meeting in full public view.

Other regulations that apply are the GSA Federal Advisory Committee Management: Final Rule (41 CFR Parts 101-6 and 102-3), and the NASA Policy Directive: FACA Committees (NPD 1150.11).

Committee Discussion, Recommendations, Future Plans—Esther Dyson et al.

Recommendations to be presented to the NAC will be circulated by e-mail for final review before the meeting next week:

- The Committee recognizes the importance of Life and Physical Sciences research in future human exploration activities and urges the Agency to engage in deliberative and inclusive discussions regarding its final home within the NASA organization structure.

- The Committee strongly supports the newly defined push model for the development of disruptive space technologies and the NASA Technology Executive Council process for managing and prioritizing future NASA technology investments.

- The Committee believes that NASA should consider embracing innovation in process areas within NASA such as business and acquisition practices, and external partnerships. The Committee was particularly impressed with the Space Operations Mission Directorate's innovative flight hardware service contract with Hamilton Sundstrand for water production services on ISS and encourages additional similar innovations along these lines or other new approaches.

- The Committee encourages NASA to engage in more cross-fertilization of personnel between NASA Centers and between NASA and outside organizations as a way encouraging innovation as the Agency plans and implements its new technology programs and in general. The Committee is also pleased by the openness of the technology research calls being proposed by the Chief Technologist.

- The Committee strongly urges NASA to quickly engage with other Federal Agencies and Departments as it develops its new technology programs. The Committee is especially eager to see engagement with the Defense Department in the areas of launch propulsion and heavy lift technology.

Future Plans Discussion

- TIC supports the newly defined push/pull model for disruptive technology and the NTEC management and prioritization structure, e.g., propulsion.
- The water production example illustrated a successful partnership, but people would more readily support exploration that would encourage such things to happen.
- Dr. Braun and the Administrator must identify key people, move them around, and give them visibility.
- Cross–fertilization with other agencies and organizations would result from innovative team formation.
- Labor mobility is encouraged.
- In addition to business innovations, TIC wants technology innovations and is trying to get specific examples.

- TIC encourages NASA to do more across Centers, industry, cross-agency, e.g., DoD, and TIC supports the openness of the technology calls that will be going out.
- Members will be able to read the other committees' NAC recommendations.
- The committee should invite Mark Uhran, Associate Administrator for the International Space Station, to speak.
- TIC would like to meet with Commercial Space Committee people this summer.

Next Meeting Agenda—Esther Dyson & Mike Green

A work plan has been drafted and circulated. Members are asked to review the work plan to refine it at the August meeting. Other possible topics include propulsion.

The next meeting will be held in August.

Adjourn

The meeting adjourned at 3:30 PM.

Participants

TIC Members

Esther Dyson, EDventure Holdings, *Chair*
Bill Ballhaus, retired, *Vice Chair*
John Cassidy, retired
Mike Green, NASA, *Executive Secretary*
Matt Mountain, Space Telescope Science Institute
Dava Newman, MIT
Alain Rappaport, Microsoft
Susan X. Ying, Boeing

Others

Robert Braun, NASA OCT
Dr. Laurie Leshin, NASA ESMD
Jason Crusan, NASA SOMD
John Emond, NASA IPP
Jefferson Gillion, NASA HQ
Mike Hecker
Peter Hughes
Rick Howard, NASA HQ
Marla King, NASA HQ
Merrill King, NASA HQ
Andrew Petro, NASA HQ
Miriam Quizzle, CalTech [*via telephone*]
Al Kobenechev
Diane Rausch, NASA HQ
Lauren Smith, NASA, ESMD
Winfield Swanson, Harris IT Services Corp, *rapporteur*

Agenda

NAC Technology and Innovation Committee Meeting

April 22, 2010
NASA Headquarters
Room MIC 7H45
300 E Street, SW
Washington, DC 20546

Toll free call-in number: 866-731-6783
Participant Passcode: 4359844

8:00	Continental Breakfast for Committee members	
8:30	Opening of Meeting, Introductions, logistics	Mike Green
8:45	Opening Remarks and Thoughts	Esther Dyson
9:00	FACA Overview	P. Diane Rausch
9:50	Break	
10:00	Exploration Systems Update and Status	Laurie Leshin
11:00	Office of Chief Technologist/Space Technology Update and Status	Bobby Braun
12:00	Working lunch with Dr. Braun	
1:00	Space Operations Technology Update and Status	Jason Crusan
2:00	Committee Discussion, Recommendations, Future Plans	Esther Dyson et al
3:00	Next Meeting Agenda	Esther Dyson & Mike Green
~3:15	Adjourn	